A new role for science—I

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Some people seem to believe that academic science is impervious to the intellectual churning occurring in the colleges and universities. I doubt the validity of the view and think that it can only lead us to a kind of asceptic fool's paradise for a group of diehard cultists. I am convinced that science and technology are in desperate need of change, just because they have been extraordinarily successful during the past half century.

I am troubled by many things: the rejection of the axiomatic goodness of science by much of our society; the frustration of problems such as environmental pollution which we cannot quite get our fingers on; the failure of tremendously capable students to find excitement in science; and the fact that I see more and more of modern chemistry as elegant but repetitive.

If we stop and think about it, some of the causes of this disquieting situation become apparent. In the period from 1950 to 1970 at least as much new knowledge was acquired in chemical science as was accumulated during the century 1850 to 1950. Yet the changes in our conceptual framework have been far smaller than those that occurred in the previous century.

We hear all too often that "Chemistry has become a mature science and its general form is fairly well set." I can't buy this conclusion, because I see so many areas of chemical science where we know almost nothing. For example, we are still almost totally at a loss in predicting the rates of chemical reactions except by comparison with the known rates of other, very closely related reactions. We are sometimes asked about the prospect of producing synthetic organic fibers with the mechanical properties of steel, or making plastic films with electrical superconducting properties. Answers to such questions show the primitive character of our understanding of the relationships between properties of materials and their chemical structure. We must admit that we do not know and can barely guess.

I think that the failure of students to find excitement in science is partly related to the discrepancy between the rate of growth of scientific knowledge and the rate of conceptual evolution. Topics that I found fascinating in the 1940's leave my students cold because what was pioneering then is now stylized and conservative. Gearing up to teach our students where it is becomes painfully difficult because we ourselves have strong personal memories of where it was.

New concepts of a field of science are hard to activate. We find ourselves trying to teach new things in new ways, and discover that our new association patterns are hard to get across because we lack experience in doing it that way. Really new experiments in teaching can be very costly in time and money. However, we can probably do more than some think. For example, it should be possible to make enormous improvements in the ways in which we use the services of graduate teaching assistants in our instructional program. Bright young graduate students have the potential for providing undergraduates the individualized attention that they desire and for contributing some of the fresh and innovative ideas that we need. We need to work intensively with teaching assistants in summer workshops to develop expertise and a sense of community objective among the entire staff involved in a new course.

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